

CLAIMS

We claim:

1. An electrical combination comprising:
5 a first battery having a Lithium-based chemistry, the first battery having a first nominal voltage in a nominal voltage range;
a second battery having a Lithium-based chemistry, the second battery having a second nominal voltage, the second nominal voltage being different than the first nominal voltage and being outside of the nominal voltage range; and
10 a battery charger operable to charge the first battery and the second battery.
2. The electrical combination as set forth in Claim 1 wherein the first battery includes an identification component having a value representing one of the first nominal voltage and the nominal voltage range, and wherein the charger is operable to identify the
15 value of the identification component.
3. The electrical combination as set forth in Claim 2 wherein the first battery includes a battery controller, the identification component including the battery controller.
- 20 4. The electrical combination as set forth in Claim 2 wherein the first battery includes a chemistry identification component having a value representing the Lithium-based chemistry of the first battery.
5. The electrical combination as set forth in Claim 4 wherein the first battery
25 includes a battery controller, the chemistry identification component including the battery controller.
6. The electrical combination as set forth in Claim 4 wherein the charger includes a controller operable to identify the value of the chemistry identification
30 component.
7. The electrical combination as set forth in Claim 2 wherein the charger includes a controller operable to identify the value of the identification component.

8. The electrical combination as set forth in Claim 7 wherein the controller is operable to control a supply of charging current to charge a battery.

5 9. The electrical combination as set forth in Claim 7 wherein the controller is operable to monitor a battery characteristic.

10. The electrical combination as set forth in Claim 9 wherein the battery characteristic includes a battery voltage.

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11. The electrical combination as set forth in Claim 9 wherein the controller is operable to control a charging function.

12. The electrical combination as set forth in Claim 11 wherein the charging
15 function includes one of termination of charging of the first battery and termination of a charging mode of charging the first battery.

13. The electrical combination as set forth in Claim 11 wherein the charging
function includes one of initiation of charging of the first battery and initiation of a
20 charging mode of charging the first battery.

14. The electrical combination as set forth in Claim 11 wherein the controller
selects a battery characteristic threshold for the charging function when the controller
identifies the value of the identification component.

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15. The electrical combination as set forth in Claim 14 wherein the battery
characteristic threshold includes a first battery voltage threshold.

16. The electrical combination as set forth in Claim 15 wherein the first battery
30 voltage threshold is related to one of the first nominal voltage and the nominal voltage range.

17. The electrical combination as set forth in Claim 14 wherein the second nominal voltage is in a second nominal voltage range, the second nominal voltage range being different than the first nominal voltage range.

5 18. The electrical combination as set forth in Claim 17 wherein the second battery includes a second identification component having a second value representing one of the second nominal voltage and the second nominal voltage range, wherein the charger is operable to identify the second value of the second identification component, the controller selecting a second battery characteristic threshold for the charging function
10 when the controller identifies the second value of the second identification component, the second battery characteristic threshold being different than the first battery characteristic threshold.

19. The electrical combination as set forth in Claim 18 wherein the charging
15 function includes one of termination of charging of the second battery and termination of a charging mode of charging the second battery.

20. The electrical combination as set forth in Claim 18 wherein the charging
20 function includes one of initiation of charging of the second battery and initiation of a charging mode of charging the second battery.

21. The electrical combination as set forth in Claim 18 wherein the battery
characteristic threshold includes a first battery voltage threshold, and wherein the second
battery characteristic threshold includes a second battery voltage threshold, the second
25 battery voltage threshold being different than the first battery voltage threshold.

22. The electrical combination as set forth in Claim 21 wherein the second
battery voltage threshold is related to one of the second nominal voltage and the second
nominal voltage range.

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23. The electrical combination as set forth in Claim 1 wherein the second nominal voltage is in a second nominal voltage range, the second nominal voltage range being different than the first nominal voltage range.

24. The electrical combination as set forth in Claim 23 wherein the second battery includes an identification component having a value representing one of the second nominal voltage and the second nominal voltage range, and wherein the charger is operable to identify the value of the identification component.

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25. The electrical combination as set forth in Claim 24 wherein the second battery includes a battery controller, the identification component including the battery controller.

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26. The electrical combination as set forth in Claim 24 wherein the second battery includes a chemistry identification component having a value representing the Lithium-based chemistry of the first battery.

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27. The electrical combination as set forth in Claim 26 wherein the second battery includes a battery controller, the chemistry identification component including the battery controller.

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28. The electrical combination as set forth in Claim 26 wherein the charger includes a controller operable to identify the value of the chemistry identification component.

29. A method of charging a battery, a first battery having a Lithium-based chemistry, the first battery having a first nominal voltage in a first nominal voltage range, a second battery having a Lithium-based chemistry, the second battery having a second nominal voltage in a second nominal voltage range, the second nominal voltage being
5 different than the first nominal voltage, the second nominal voltage range being different than the first nominal voltage range, a battery charger being operable to charge the first battery and the second battery, said method comprising the acts of:

electrically connecting the battery charger and the first battery;
charging the first battery;
10 electrically connecting the battery charger and the second battery; and
charging the second battery.

30. The method as set forth in Claim 29 and further comprising the act of identifying one of a nominal voltage and a nominal voltage range of one of the first battery
15 and the second battery.

31. The method as set forth in Claim 29 and further comprising the act of receiving a signal from the battery, the signal being indicative of one of a nominal voltage and a nominal voltage range of one of the first battery and the second battery.
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32. The method as set forth in Claim 29 and further comprising the act of identifying the chemistry of one of the first battery and the second battery.

33. The method as set forth in Claim 29 and further comprising the act of receiving a signal from the battery, the signal being indicative of the chemistry of one of
25 the first battery and the second battery.

34. The method as set forth in Claim 29 and further comprising the act of monitoring a battery characteristic.
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35. The method as set forth in Claim 34 wherein the monitoring act includes the act of monitoring a battery voltage.

36. The method as set forth in Claim 34 and further comprising the act of controlling a charging function based on one of a nominal voltage and a nominal voltage range of the one of the first battery and the second battery.

5 37. The method as set forth in Claim 36 wherein the controlling act includes controlling one of the act of terminating charging of one of the first battery and the second battery and the act of terminating a charging mode of charging of one of the first battery and the second battery.

10 38. The method as set forth in Claim 36 wherein the controlling act includes controlling one of the act of initiating charging of one of the first battery and the second battery and the act of initiating a charging mode of charging of one of the first battery and the second battery.

15 39. The method as set forth in Claim 36 and further comprising the act of selecting a battery characteristic threshold for the charging function based on one of a nominal voltage and a nominal voltage range of the one of the first battery and the second battery.

20 40. The method as set forth in Claim 39 and further comprising the act of selecting a first battery characteristic threshold for the charging function based on one of the first nominal voltage and the first nominal voltage range of the first battery.

25 41. The method as set forth in Claim 40 and further comprising the act of selecting a second battery characteristic threshold for the charging function based on one of the second nominal voltage and the second nominal voltage range of the second battery, the second battery characteristic threshold being different than the first battery characteristic threshold.

42. A battery having a Lithium-based chemistry, the battery having a nominal voltage in a nominal voltage range, the battery comprising:

a chemistry identification component indicative of the chemistry of the battery; and

5 an identification component indicative of one of the nominal voltage and the nominal voltage range of the battery;

wherein the battery is operable with an electrical device, power being transferable between the battery and the electrical device, the chemistry of the battery and the one of the nominal voltage and the nominal voltage range of the battery being
10 identifiable by the electrical device.

43. The battery as set forth in Claim 42 wherein the battery includes a controller, the chemistry identification component including the controller.

15 44. The battery as set forth in Claim 42 wherein the battery includes a controller, the identification component including the controller.

45. The battery as set forth in Claim 42 wherein the electrical device includes a battery charger operable to supply a charging current to the battery to charge the battery,
20 the chemistry of the battery and the one of the nominal voltage and the nominal voltage range of the battery being identifiable by the battery charger.

46. An electrical combination comprising:
a battery charger operable to supply a charging current to a battery to charge the battery; and
a battery including a switch having an interrupt condition, in which the
5 switch is operable to interrupt a discharge current from the battery, the battery being electrically connectable to the battery charger, the supply of the charging current from the battery charger to the battery being enabled when the switch is in the interrupt condition.

47. The electrical combination as set forth in Claim 46 wherein the switch
10 includes a FET, the FET having an interrupt condition, in which the FET is operable to interrupt a discharge current from the battery, the FET including a body diode, the supply of the charging current from the battery charger to the battery being enabled through the body diode when the FET is in the interrupt condition.

15 48. The electrical combination as set forth in Claim 47 wherein the battery includes a controller operable to control the switch.

49. The electrical combination as set forth in Claim 48 wherein the controller is operable to control the switch between the interrupt condition and a second condition, in
20 which a current is suppliable through the switch.

50. The electrical combination as set forth in Claim 49 wherein the battery includes a cell operable to supply a voltage to the controller, and wherein the controller has an operating voltage threshold, the controller being operable when the cell supplies a
25 voltage to the controller one of equal to and greater than the operating voltage threshold.

51. The electrical combination as set forth in Claim 50 wherein the controller is operable to change the switch from the interrupt condition to the second condition when the battery is electrically connected to the battery charger and when a voltage one of equal
30 to and greater than the operating voltage threshold is supplied to the controller.

52. The electrical combination as set forth in Claim 51 wherein, in the second condition, charging current is suppliable through the switch to the cell to charge the cell.

53. The electrical combination as set forth in Claim 51 wherein, when the battery is electrically connected to the battery charger and when a voltage less than the operating voltage threshold is supplied to the controller, the controller is not operable to change the switch from the interrupt condition to the second condition.

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54. The electrical combination as set forth in Claim 53 wherein the supply of the charging current from the battery charger to the battery when the switch is in the interrupt condition increases the voltage supplied to the controller to one of equal to and greater than the operating voltage threshold.

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55. The electrical combination as set forth in Claim 54 wherein, thereafter, the controller is operable to change the switch from the interrupt condition to the second condition.

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56. The electrical combination as set forth in Claim 55 wherein, thereafter, in the second condition, charging current is suppliable through the switch to the cell to charge the cell.

57. A method of operating an electrical combination, the electrical combination including a battery charger operable to supply a charging current to a battery, and a battery including a switch having an interrupt condition, in which the switch is operable to interrupt a discharge current from the battery, the battery being electrically connectable to the battery charger, said method comprising the act of enabling the supply of the charging current from the battery charger to the battery when the switch is in the interrupt condition.

58. The method as set forth in Claim 57 wherein the switch includes a FET, the FET having an interrupt condition, in which the FET is operable to interrupt a discharge current from the battery, the FET including a body diode, and wherein said method further comprises the act of enabling the supply of the charging current from the battery charger to the battery through the body diode when the FET is in the interrupt condition.

59. The method as set forth in Claim 57 and further comprising the act of controlling the switch between the interrupt condition and a second condition, in which a current is suppliable through the switch.

60. The method as set forth in Claim 57 wherein the battery includes a cell operable to supply a voltage to the controller and a controller having an operating voltage threshold, and wherein said method further comprises the act of operating the controller when a voltage one of equal to and greater than the operating voltage threshold is supplied to the controller.

61. The method as set forth in Claim 60 and further comprising the act of, with the controller, changing the switch from the interrupt condition to a second condition, in which a current is suppliable through the switch, when the battery is electrically connected to the battery charger and when a voltage one of equal to and greater than the operating voltage threshold is supplied to the controller.

62. The method as set forth in Claim 61 and further comprising, when the switch is in the second condition, the act of supplying charging current through the switch to the cell to charge the cell.

63. The method as set forth in Claim 60 wherein, when the battery is electrically connected to the battery charger and when a voltage less than the operating voltage threshold is supplied to the controller, the controller is not operable to change the switch from the interrupt condition to the second condition, and wherein said method
5 further comprises the act of increasing the voltage supplied by the cell to the controller to one of equal to and greater than the operating voltage threshold.

64. The method as set forth in Claim 63 and further comprising, after the increasing act, the act of, with the controller, changing the switch from the interrupt
10 condition to the second condition.

65. The method as set forth in Claim 64 and further comprising, after the changing act, the act of supplying charging current through the switch to the cell to charge the cell.
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66. A battery comprising:
a cell operable to supply a discharge current; and
a switch having an interrupt condition, in which the switch is operable to
interrupt the discharge current from the cell, and a second condition, in which the current
5 is suppliable through the switch;

wherein the battery is electrically connectable to a battery charger, the
supply of the charging current from the battery charger to the cell being enabled when the
switch is in the interrupt condition, charging current being suppliable through the switch
when the switch is in the second condition.

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67. The battery as set forth in Claim 66 wherein the switch includes a FET, the
FET having an interrupt condition, in which the FET is operable to interrupt a discharge
current from the battery, and a second condition, in which current is suppliable through the
FET, the FET including a body diode, the supply of the charging current from the battery
15 charger to the cell being enabled through the body diode when the FET is in the interrupt
condition, charging current being suppliable through the FET when the FET is in the
second condition.

68. An electrical combination comprising:
a first battery having a Lithium-based chemistry;
a second battery having one of a Nickel-Cadmium and a Nickel-Metal-
Hydride chemistry; and
5 a battery charger operable to charge the first battery and the second battery.

69. The electrical combination as set forth in Claim 68 and further comprising a
third battery having the other of a Nickel-Cadmium and a Nickel-Metal-Hydride
chemistry, and wherein the battery charger is operable to charge the third battery.

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70. The electrical combination as set forth in Claim 68 wherein the battery
charger is operable to identify the Lithium-based chemistry of the first battery.

71. The electrical combination as set forth in Claim 70 wherein the first battery
15 includes an identification component indicative of the Lithium-based chemistry of the first
battery, and wherein the battery charger receives a signal indicative of the Lithium-based
chemistry of the first battery.

72. The electrical combination as set forth in Claim 70 wherein the battery
20 charger includes a controller operable to identify the Lithium-based chemistry of the first
battery.

73. The electrical combination as set forth in Claim 68 wherein the battery
charger includes a charging circuit connectable to a power source and operable to supply a
25 charging current to the first battery and to the second battery.

74. The electrical combination as set forth in Claim 73 wherein the battery
charger includes a controller operable to control the charging circuit and to control the
charging current supplied through the charging circuit to the first battery and to the second
30 battery.

75. The electrical combination as set forth in Claim 74 wherein the controller is operable to identify the Lithium-based chemistry of the first battery and to control the charging circuit to control charging current supplied through the charging circuit to the first battery.

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76. The electrical combination as set forth in Claim 74 wherein the controller is operable to control the charging circuit to supply charging current by a first charging algorithm to the first battery and by a second charging algorithm to the second battery, the first charging algorithm being different than the second charging algorithm.

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77. The electrical combination as set forth in Claim 68 wherein the first battery has a first nominal voltage in a first nominal voltage range, wherein said electrical combination further comprises a third battery having a nominal voltage in a nominal voltage range, the nominal voltage of the third battery being different than the first nominal voltage, the nominal voltage range of the third battery being different than the first nominal voltage range, and wherein the battery charger is operable to charge the third battery.

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78. The electrical combination as set forth in Claim 77 wherein the battery charger is operable to identify one of a nominal voltage and a nominal voltage range of the first battery and of the third battery.

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79. A battery charger:
at least one terminal to electrically connect to a lithium-based chemistry
battery pack, the battery pack having a nominal voltage; and
a controller operable to provide a charging current to the battery pack
5 through the at least one terminal, the controller operable to select a threshold for a
charging function according to a nominal voltage of the battery pack.

80. The battery charger as set forth in Claim 79 wherein the nominal voltage of
the battery pack is included in the voltage range of approximately 9.6 –V to approximately
10 30-V.

81. The battery charger as set forth in Claim 79 wherein the controller includes
a first charging module and a second charging module, the first charging module operable
to provide a first charging current to the battery pack and the second charging module
15 operable to provide a second charging current to the battery pack.

82. The battery charger as set forth in Claim 81 wherein the first charging
current and the second charging current differ in one of average current amplitude and
duty-cycle.
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83. The battery charger as set forth in Claim 82 wherein the first charging
module includes a fast charge module.

84. The battery charger as set forth in Claim 83 wherein the first charging
25 current includes a fast charge current.

85. The battery charger as set forth in Claim 81 wherein the controller further
includes a third charging module and a fourth charging module, the third charging module
operable to provide a third charging current to the battery pack and the fourth charging
30 module operable to provide a fourth charging current.

86. The battery charger as set forth in Claim 85 wherein the first charging module is a fast charging module, the second charging module is a step charging module, the third charging module is a trickle charging module, and the fourth charging module is a maintenance charging module.

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87. The battery charger as set forth in Claim 86 wherein the first charging current is a fast charge current, the second charging current is a step charge current, the third charging current is a trickle charge current, and the fourth charging current is a maintenance charge current.

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88. The battery charger as set forth in Claim 81 wherein the controller includes a charging algorithm.

89. The battery charger as set forth in Claim 88 wherein the controller implements the charging algorithm in the first charging module and in the second charging module.

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90. The battery charger as set forth in Claim 89 wherein the controller implements the charging algorithm in a first manner in the first charging module and in a different second manner in the second charging module.

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91. The battery charger as set forth in Claim 89 wherein the controller further includes a third charging module and a fourth charging module, the third charging module operable to provide a third charging current to the battery pack and the fourth charging module operable to provide a fourth charging current, the controller implementing the charging algorithm in the third charging module and in the fourth charging module.

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92. The battery charger as set forth in Claim 91 wherein the first charging module is a fast charging module, the second charging module is a step charging module, the third charging module is a trickle charging module, and the fourth charging module is a maintenance charging module.

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